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## SCALING THE ASSOCIATION BETWEEN COLORS AND MOOD-TONES

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By K. WARNER SCHAEFFER, University of Nebraska

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## SCALING THE ASSOCIATION BETWEEN COLORS AND MOOD-TONES

By K. WARNER SCHAFF, University of Nebraska

It is the purpose of the present study to investigate some semantic correlates of response to color. The approach to be taken will assess the strength of association between colors and mood-tones. The stability of such associations will be investigated both with respect to retest reliability within an experimental group and over different groups. An attempt will also be made to identify the dimensions underlying the system of associations by an examination of a representative sample of colors and mood-tones. Such an approach, it is hoped, will provide information regarding the methodology required for normative studies of the semantic correlates of colors and incidentally may help to generate facts and hypotheses required for a rationale for the use of the response to color as a tool for the study of personality.

Fairly complete reviews of the literature on the relation of color and affect may be found in Presser<sup>1</sup> and Norman and Scott.<sup>2</sup> Studies directly relevant to the present problems are primarily those by Odbert, Karwowski and Eckerson,<sup>3</sup> a study by Tannenbaum and Osgood is also pertinent.<sup>4</sup> Odbert *et al.* found that certain colors were chosen more often to go with specific groups of words describing moods. A partially 'forced' method of choice, however, permitted differential emphasis on the various colors, and all moods were fitted to a color-circle (arranged according to wave-lengths) in terms of the authors' judgments.

Wexner also found relations between colors and mood-tones using more refined procedures. She prepared a list of 164 adjectives and had judges choose words which they felt to refer to mood-tones reported in the literature. Groups of words referring to 11 mood-tones were selected. Eight colors were then presented to a group

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<sup>1</sup> S. L. Presser, The influence of color upon mental and motor efficiency, this JOURNAL, 32, 1921, 326-356.

<sup>2</sup> R. D. Norman and W. A. Scott, Color and affect: A review and semantic evaluation, *J. gen. Psychol.*, 36, 1952, 185-223.

<sup>3</sup> H. S. Odbert, T. F. Karwowski, and A. B. Eckerson, Studies in synthetic thinking: I. musical and verbal associations of color and mood, *J. gen. Psychol.*, 26, 1942, 153-173.

<sup>4</sup> L. B. Wexner, The degree to which colors (hues) are associated with mood-tones, *J. appl. Psychol.*, 38, 1954, 423-435.

<sup>5</sup> In C. E. Osgood, G. J. Suci and P. H. Tannenbaum, *The Measurement of Meaning*, 1957, 282-283.

of students, who were asked to select the color which seemed to go best with each mood-tone, each color being permitted to be used more than once. Her results suggest that more than one color may be associated to a given mood-tone and that the same color may be associated with several mood-tones. Her method handles the latter contingency, but does not permit S to indicate that more than one color is felt to be strongly associated with a given mood-tone. Her results also suggest that some colors are rarely or never associated with certain mood-tones.

Osgood and Tannenbaum used the semantic differential to study color meaning. This study involved the attribution of the meaning of color in different objects. Significant differences were found to exist between colors for non-evaluative rating variables while the interactions between colors and objects were found to be significant for rating variables having evaluative properties. Factor analysis yielded significant differences among colors on factors of activity, evaluation and potency. The nature of the measurements used, however, did not provide precise measures of the relative magnitudes of the relationships between color and meaning.

### PROCEDURE

A promising approach to the scaling of many psychological variables is the constant-sum method.<sup>6</sup> This method requires the judge to indicate the relative magnitude of two stimuli by dividing 100 points between them. The procedure generally used in the constant-sum method is patterned after the method of paired comparisons requiring a large number of indirect estimates and introducing different judgmental biases depending on the dissimilarity of the stimuli to be compared. A clearer operational meaning for the scaling operation is provided by a modified technique using the method of the constant stimulus.<sup>7</sup> This modification has been used as the model for the present study.

The mood-tones used in this experiment were taken from the above-mentioned study by Wexner.<sup>8</sup> Each of the 11 mood-tones was described by two or more adjectives as follows: exciting, stimulating; secure, comfortable; distressed, disturbed, upset, tender, soothing; protective, defending; despondent, dejected, unhappy, melancholy; calm, peaceful, serene; dignified, stately; cheerful, jovial, joyful; defiant, contrary, hostile; and powerful, strong, masterful. To get some clue as to color-preference the mood-description of 'pleasant' was added. Ten colors were used, representing the principal hues to which associations were found mentioned in the literature. Stoelting's colored papers were used; maximally saturated spectral as well as neutral colors were selected. They included: Red (Stoelting #1), Orange (#3), Yellow (#5), Green (#7), Blue (#13), Purple (#14), White (#17), Black (#18), and Gray (#19).

Since Brown is frequently mentioned in the literature but is not available in the Stoelting series, a commercial paper was used for this hue.<sup>9</sup> Pieces 2 X 2 in. square

<sup>6</sup> Milton Metzessel, A proposal for quantitative reporting of comparative judgments, *J. Psychol.*, 24, 1947, 229-235. See also A. L. Comrey, A proposed method for absolute ratio scaling, *Psychometrika*, 15, 1950, 317-325.

<sup>7</sup> K. E. Baker and F. J. Dudek, Scaling line-lengths with a modification of the constant-sum method, this JOURNAL, 70, 1957, 81-86.

<sup>8</sup> Wexner, *op. cit.*, 432-435.

<sup>9</sup> Approximate Munsell characteristics of the papers are as follows: Red, 5 R 4/10; orange, 10 R 5/5; yellow, 7.5 Y 8/8; green, 5 GY 8/8; blue, 7.5 PB 4/16; purple, 10 PB 3/8; white, N 9.5; gray, 7.5 PB 6/2; black, N 2; brown 10 YR 4/2.

were mounted on neutral gray backgrounds and shown in pairs on a large screen by means of an opaque projector. Red was used as the constant stimulus and paired with each of the other nine hues.

The mood-descriptions were presented in a test-booklet, all 12 moods being listed on a separate page for each of the 9 pairs of stimuli. The presentation of mood-tones was arranged in a random order which differed for each of the stimulus-pairs. Nine different page arrangements were also used to randomize the effect of a specific order of arrangement for a given stimulus-pair. The stimuli were presented in a standard-sequence following the color-spectrum and concluding with the neutral colors.

Two groups of judges were used, viz. two sections of the course in experimental psychology. The first group consisted of 23 and the second of 21 judges. Twenty-five of the judges were men and 19 were women. The judges were instructed to divide 100 points between the members of each pair of colors to indicate the relative degree of association with each of the mood-descriptions listed in the test-booklets. Prior to making the judgments the judges were informed of the implications of making various types of ratio-judgments by means of examples drawn from the judgment of line-lengths in terms of point-divisions.

RESULTS

The procedure for deriving scale-values for stimuli from point assignments has been described by Baker and Dudek.<sup>10</sup> The points assigned to the red stimulus in comparison with all the other hues were totaled and the ratio of the sum of all possible points to the total for red was calculated for each hue compared. These scale-values were then normalized to permit comparison between scales for the different mood-tones. Table I presents the normalized scale-values for the two groups of judges. The unit for the normalized scale-values is defined as unity divided by the square root of the sum of the raw scale-values.

Examination of Table I shows that the scale-values for those colors rated high or low with respect to any given mood-description appear to be well-replicated, while there are many exchanges in rank-order about the middle of each scale. Only 3 of the 12 scales show an exchange for the color being scaled as most strongly associated from one sample to the next, and only in one of these 3 instances is there a shift other than among closely adjacent values. None of the shifts in scale-values between the two samples is significant at the 5% level of confidence (*t*-test of the difference between mean point-assignments).

Table I also gives the correlation for the scale-values on each scale between the two groups of judges. These range from 0.652 to 0.946 with an average of 0.816, suggesting not only fairly good scale-reliability, but also the presence of universal color-mood associates in the population.

<sup>10</sup> Baker and Dudek, *op. cit.*, 81-86.

TABLE I  
NORMALIZED SCALE-VALUES FOR THE RELATIVE STRENGTH OF ASSOCIATION BETWEEN COLORS AND MOOD-DESCRIPTIONS  
(Obtained from two independent samples of 23 and 21 judges)

Color	Mood-descriptions*																							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)												
Red	369	388	290	280	321	307	220	230	461	499	199	184	224	180	307	338	306	317	373	465	426	461	327	266
Orange	453	484	244	264	279	290	182	230	268	295	163	187	191	173	150	199	324	377	433	316	217	287	278	246
Yellow	483	540	253	252	272	238	340	251	226	191	108	147	217	194	144	152	658	520	239	344	188	150	419	358
Green	380	226	192	258	295	244	257	295	180	172	193	172	215	269	107	128	361	386	302	323	124	136	229	322
Blue	380	387	517	516	212	170	566	503	360	348	185	191	435	539	500	380	340	471	224	210	396	394	573	606
Purple	217	194	372	287	339	362	303	276	406	283	386	412	350	241	500	407	187	175	246	287	337	311	226	241
White	199	202	299	323	224	194	332	412	254	349	195	197	377	473	261	378	232	214	168	178	136	221	272	283
Gray	122	105	377	256	263	405	364	340	272	220	360	577	484	363	251	213	125	139	190	191	145	167	275	234
Black	147	149	186	224	490	485	158	190	318	409	629	458	233	231	402	501	076	097	545	470	593	552	154	131
Brown	118	106	291	393	372	328	237	307	314	241	370	304	278	265	242	240	113	107	231	212	243	175	187	245
<i>r</i> <sub>12</sub>		.632		.769		.803		.880		.737		.716		.797		.847		.921		.825		.946		.914

\* Key to mood-descriptions: (1) exciting, stimulating; (2) secure, comfortable; (3) distressed, disturbed, upset; (4) tender, soothing; (5) protective, defending; (6) despondent, dejected, melancholy, unhappy; (7) calm, peaceful, serene; (8) dignified, stately; (9) cheerful, jovial, joyful; (10) defiant, contrary, hostile; (11) powerful, strong, masterful; (12) pleasant.

TABLE II  
INTERCORRELATIONS AMONG THE SCALE-VALUES FOR THE STRENGTH OF ASSOCIATION BETWEEN COLORS AND MOOD-DESCRIPTIONS  
(Above diagonal: Sample I=23 judges; Below diagonal: Sample II=21 judges)

	Mood-Descriptions											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)												
(2)	.04											
(3)	.52	-.55										
(4)	.10	.82	-.63									
(5)	.08	.10	.14	-.09								
(6)	.71	-.27	.82	-.14	-.05							
(7)	.24	.60	-.46	.96	.02	.02						
(8)	.30	.19	-.32	.09	.74	.32	.27					
(9)	.71	-.17	-.59	-.13	.78	.48	-.09	-.36				
(10)	.29	-.54	.41	-.11	.70	.21	.07	.21	.07			
(11)	.06	.05	.36	-.21	.87	.13	.07	.81	-.13	.06		
(12)	.46	-.78	-.78	.76	-.09	-.52	.61	.12	.59	-.37	-.10	

These values may be contrasted with the intercorrelations among scales for each single group of raters shown in Table II, which for all color-mood combinations average 0.054 and 0.079 for the two groups of judges respectively. It appears, then, that the variance common to the two groups of raters for any given scale is much in excess of the average relation among a sample of scales originating from the same judges.

Since the scales shown in Table I are ratio-scales (by definition of our scaling model) the assumptions for Pearson product-moment correlation are met, and intercorrelations can be computed among all the scales for both groups of judges. These correlations are shown in Table II, the correlations for Group I being above, and those for Group II below, the diagonal. Another test of the hypothesis that the scale-structure for the two groups of judges is identical was made by means of an adaptation of the Kolmogorov-Smirnov test.<sup>11</sup> The largest discrepancy fails to reach significance at the 1% level of confidence, and there is every reason to believe that differences in the magnitude of the intercorrelations are due to chance.

Interpretation of the scale-values obtained in this experiment suggests that the mood 'exciting, stimulating' has its strongest association with yellow and orange; 'secure, comfortable' with blue; 'distressed, disturbed, upset' with black; 'tender, soothing' with blue; 'protective, defending' with red; 'despondent, dejected, melancholy, unhappy' with gray and black; 'calm, peaceful, serene' with blue, white, and gray; 'dignified, stately' with purple, black, and blue; 'cheerful, jovial, joyful' with yellow; 'defiant, contrary, hostile' with black; and 'powerful, strong, masterful' with black.

A descriptive schema ordering the mood-descriptions with respect to each color is summarized in Table III. These findings confirm in part the results reported by Wexner although transpositions occur, particularly where the colors added in the present study assume a significantly high or low scale-position.

*Reliability of scale-values.* While there is good replication of scale-values from one sample of judges to the next, the question still remains as to how reliable our scales would be when scaling is repeated by the same judges. Such a repetition was carried out by the judges in Sample II after a 3-month interval. Scale-values obtained on the two occasions were correlated and Table IV lists the stability-coefficients for the repeated scaling. These were found to range from 0.78 for 'protective, defending' to 0.98 for 'pleasant' and 'exciting, stimulating.'

*Factorial structure of the system of color-mood scales.* A centroid factor-

<sup>11</sup> K. W. Schaik, Tests of hypotheses about differences between two intercorrelation matrices, *J. exp. Educ.*, 26, 1938, 241-245.

TABLE III  
DESCRIPTIVE SCHEME FOR THE ASSOCIATION BETWEEN COLORS  
AND MOOD-TONES

Color	Strong association	Little or no association
Red	protective, defending; powerful, strong, masterful; (exciting, stimulating)*	Calm, peaceful, serene; tender, soothing
Orange	exciting, stimulating	calm; peaceful, serene; tender, soothing; dignified, stately
Yellow	exciting, stimulating; cheerful, jovial, joyful; pleasant	dignified, stately; despondent, dejected, melancholy, unhappy; protective, defending; powerful, strong, masterful
Green		dignified, stately; protective, defending; powerful, strong, masterful; despondent, dejected, melancholy, unhappy
Blue	pleasant; secure, comfortable; tender, soothing; (calm, peaceful, serene; exciting, stimulating)	distressed, disturbed, upset; despondent, dejected, melancholy, unhappy; defiant, contrary, hostile
Purple	dignified, stately; (despondent, dejected, melancholy, unhappy)	exciting, stimulating; cheerful, jovial, joyful
Brown	(secure, comfortable)	cheerful, jovial, joyful; defiant, contrary, hostile; exciting, stimulating; powerful, strong, masterful; pleasant
White	tender, soothing; (calm, peaceful, serene)	exciting, stimulating; despondent, dejected, melancholy, unhappy; defiant, contrary, hostile; distressed, disturbed, upset; powerful, strong, masterful
Gray	despondent, dejected, melancholy, unhappy (calm, peaceful, serene)	exciting, stimulating; defiant, contrary, hostile; powerful, strong, masterful; cheerful, jovial, joyful
Black	distressed, disturbed, upset; defiant, contrary, hostile; despondent, dejected, melancholy, unhappy; dignified, stately; powerful, strong, masterful	exciting, stimulating; secure, comfortable; tender, soothing; cheerful, jovial, joyful; calm, peaceful, serene; pleasant

\* Parentheses indicate moderate associations or mood-tones whose scalar order varied between the two groups of judges.

TABLE IV  
STABILITY COEFFICIENTS FOR SCALE-VALUES FROM REPEATED  
RATING BY THE SAME JUDGES  
(N=20)\*

(1) Exciting, stimulating	.98
(2) Secure, comfortable	.86
(3) Distressed, disturbed, upset	.90
(4) Tender, soothing	.95
(5) Protective, defending	.78
(6) Despondent, dejected, melancholy, unhappy	.86
(7) Calm, peaceful, serene	.91
(8) Dignified, stately	.86
(9) Cheerful, jovial, joyful	.94
(10) Defiant, contrary, hostile	.84
(11) Powerful, strong, masterful	.92
(12) Pleasant	.98

\* One of the original judges was unavailable for the repeat experiment.

analysis was next performed on the correlation-matrix for Group I, leading to the extraction of six factors, four of which could be interpreted after appropriate orthogonal rotation. The second matrix was then factored and rotated to the structure suggested by the first matrix, resulting in essential replication, even though there were some minor differences. No direct comparison or exact test of significance seemed available, but the outcome of the test of the differences between the two correlation-matrices would tend to suggest that any differences between the samples in factor-loadings are predominantly a function of chance-variability.

Factor I was identified as an activity-passivity factor. The cluster at the active extreme included the mood-tones: 'exciting, stimulating'; 'cheerful, jovial'; and 'pleasant'. At the passive extreme the mood-tones were: 'distressed, disturbed'; 'despondent, dejected'; 'calm, peaceful'; 'dignified, stately'. The second factor seemed to relate to the positive or negative quality of the emotional tone of the mood-state. At its positive end it included the descriptions: 'calm, peaceful'; 'secure, comfortable'; 'tender, soothing'; 'dignified, stately'; and 'pleasant'. The mood-tones having negative qualities included: 'distressed, disturbed'; 'despondent, dejected'; and 'defiant, contrary'. Factor III was identified as a factor of strength or power. It included the scales: 'secure, comfortable'; 'protective, defending'; 'dignified, stately'; 'defiant, contrary, hostile'; and 'powerful, strong, masterful'. Factor IV seemed to be concerned with emotional control or mastery of the situation with 'protective, defending' at the positive and 'despondent, dejected' at the negative extreme.<sup>12</sup>

It should be stressed that the factors described above do not refer to a clustering of mood-tones *per se*, but rather to the clustering of color-associations to mood-tones. To clarify this matter, scale-values were summed for each color over the scales having substantial loadings on each factor. Factor I (activity-passivity) is positively associated with yellow and negatively associated with black and purple and to a lesser extent with gray and brown. Factor II (quality of emotional tone) is positively associated with blue, somewhat positively with gray, white and yellow, and negatively associated with black. Factor III (mood-strength) is positively associated with black, blue, purple, and red and negatively associated with green and yellow. Factor IV (emotional control) is positively associated with black, somewhat positively with purple, and negatively associated with yellow and green.

These findings invite comparison with Tannenbaum and Osgood's

<sup>12</sup> Contributions of these factors to the common variance are approximately as follows: Factor I, 26%; Factor II, 27%; Factor III, 21%; Factor IV, 4%.

data.<sup>13</sup> Our activity-passivity factor seems to match their activity-factor. In both studies yellow appears at the active and purple at the passive end. The match is not as good for some of the other colors. Our factor involving 'quality of emotional tone' would seem to correspond to Osgood's evaluative factor. Here there is a distinct discrepancy, since these authors report yellow to be at the positive extreme, while in the present study it was found to be at the negative end of the factor. The disagreement on the evaluative dimension may well be a function of the particular stimulus-objects selected for the study. Our factor of mood-strength could correspond to their potency-factor, for which ordering of colors in terms of saturation is reported, which seems to be supported by our findings.

#### SUMMARY

The association between 11 adjectival mood-descriptions as well as the term 'pleasant' with 10 colors was scaled by means of a variation of the constant-sum method using the constant-stimulus model. Scale-values were obtained for each color on each mood-tone from two groups of judges, one of which repeated judgments after a three-month interval. Scale-values show reasonably good replication from one group of raters to the other and for the same group over time. Low and high scale-values are well replicated but many changes of position occur for intermediate values. Some colors are found to be associated with several mood-tones and some mood-tones are associated with more than one color.

Intercorrelations of scale-values between colors and mood-tones were factored and four factors were identified. These factors were interpreted as the dimensions of activity-passivity, quality of emotional tone, mood-strength and emotional control.

Previous findings of associative relations between colors and mood-tones as well as some of their semantic dimensions are confirmed. A methodology producing reasonable stable scales is described. Findings of scalar consistencies as well as a wide range of individual differences suggest the desirability of future normative studies.

<sup>13</sup> Tannenbaum and Osgood, *op. cit.*, 282-283.